Claims

[c1]   A system for monitoring, configuring, programming
and/or diagnosing operation of at least one vehicle,
comprising:

an on-board unit disposed on the vehicle to send
and receive data corresponding to at least one vehi-
cle operating characteristic;

a plurality of modular applications, each application
having an associated function that processes the
data corresponding to said at least one vehicle oper-
ating characteristic obtained via the on-board unit;
and

an interface that allows selection among the plurality
of modular applications to create a customized sys-
tem.

[c2]   The system of claim 1, wherein the on-board unit in-
cludes:

at least one on-board unit interface to support com-
munication between the on-board unit and at least
one device outside the on-board unit;

a processor that manages the data sent and received
by the on-board unit via said at least one interface;

and

a memory coupled to the processor.

[c3]   The system of claim 2, wherein said at least one on-board unit interface is at least one selected from the group consisting of:

a wireless interface that supports communication with a wireless communication system;

a vehicle interface that supports communication with at least one vehicle component via a vehicle data bus;

a user interface that supports communication with a user;

a serial interface that supports communication with at least one of a driver interface and an on-vehicle device; and

a global positioning interface that supports communication with a global positioning system (GPS) device.

[c4]   The system of claim 3, wherein the vehicle interface includes at least one selected from the group consisting of:

a data parser/requester module that handles non-application specific interfacing between the processor and the vehicle data bus; and

an application specific module coupled to the data parser/requestor module that handles application

specific interfacing between the processor and the vehicle data bus.

[c5]   The system of claim 1, wherein the modular applications are selected from the group consisting of third-party applications, system-supplied applications, and core services.

[c6]   The system of claim 5, wherein at least one of the third-party applications and system-supplied applications function using information from at least one core service.

[c7]   The system of claim 5, wherein the core services include a snapshot service that obtains a set of vehicle parameter values over time.

[c8]   The system of claim 7, wherein the snapshot service causes the on-board unit to cache a selected number of parameter readings with respect to a triggering event.

[c9]   The system of claim 8, wherein the on-board unit caches the selected number of parameter readings by storing a plurality of parameter readings at selected time intervals.

[c10]   The system of claim 5, wherein the core services include a get stored values service that outputs at least one vehicle controller value in response to a request, wherein

the get stored values service outputs a current vehicle controller value if the vehicle controller is available at the time of the request and output a stored vehicle controller value in the on-board unit if the vehicle controller is not available at the time of the request.

[c11]   The system of claim 10, wherein the get stored values service collects vehicle controller values at a selected time interval and stores a most recent vehicle controller value as the current vehicle controller value.

[c12]   The system of claim 5, wherein the core services include an alert service that detects at least one of a solicited fault and an unsolicited fault.

[c13]   The system of claim 12, wherein the alert service detects a solicited fault by filtering faults and outputting only faults solicited by a user.

[c14]   The system of claim 12, wherein the alert service includes at least one of the functions from the group consisting of adding and removing individual faults, canceling the alert service for a given fault after an alert has been fired, firing an alert after a parameter exceeds a selected threshold for a selected time period, and comparing a saved parameter with a current parameter to detect tampering.

[c15] The system of claim 5, wherein the core services include a change parameter service that changes at least one vehicle parameter in response to a request.

[c16] The system of claim 1, wherein the interface is at least one selected from the group consisting of:

a user interface that supports interaction with a human user; and

a machine-to-machine interface.

[c17] The system of claim 16, wherein the user interface is a graphical user interface.

[c18] The system of claim 1, further comprising a server linking the on board unit to the interface via the modular applications.

[c19] The system of claim 18, wherein the server includes at least one of the group consisting of:

a web/application server containing logic defining the modular applications;

a vehicle server that acts as a translator between the modular applications and the on-board unit;

a communications server to support communication via a wireless network; and

a database server containing at least one relational data table retaining information associated with the

vehicle.

[c20] The system of claim 18, wherein at least one of the server and the modular applications form an application service provider (ASP) infrastructure.

[c21] The system of claim 1, wherein the plurality of modular applications include a remote diagnostics application.

[c22] The system of claim 1, wherein the plurality of modular applications include a leased vehicle management application.

[c23] The system of claim 1, wherein the plurality of modular applications includes at least one from the group consisting of a remote diagnostics application, a leased vehicle management application, a fuel economy application, a vehicle locating application, a trip reporting application, an engine management application, a maintenance alert application, a vehicle configuration application, and a warranty management application.

[c24] The system of claim 1, wherein at least one of the plurality of modular applications correlates data between at least two vehicle controllers on the same vehicle.

[c25] The system of claim 1, wherein at least one of the plurality of modular applications establishes a setting for a

plurality of vehicles with one command sent via the interface.

[c26] An on-board unit disposed on a vehicle for use in a system for monitoring, configuring, programming and/or diagnosing operation of at least one vehicle, comprising:

at least one on-board unit interface to support communication between the on-board unit and at least one device outside the on-board unit;

a processor that manages the data sent and received by the on-board unit via said at least one interface; and

a memory coupled to the processor.

[c27] The on-board unit of claim 26, wherein said at least one on-board unit interface is at least one selected from the group consisting of:

a wireless interface that supports communication with a wireless communication system;

a vehicle interface that supports communication with at least one vehicle component via a vehicle data bus;

an on-board user interface that supports communication with a user;

a serial interface that supports communication with at least one of a driver interface and an on-vehicle device; and

a global positioning interface that supports commu-

nication with a global positioning system (GPS) device.

[c28] The on-board unit of claim 26, wherein the vehicle interface includes at least one selected from the group consisting of:

a data parser/requester module that handles non-application specific interfacing between the processor and the vehicle data bus; and

an application specific module coupled to the data parser/requestor module that handles application specific interfacing between the processor and the vehicle data bus.

[c29] A method for monitoring, configuring, programming and/or diagnosing operation of at least one vehicle, comprising:

obtaining data corresponding to at least one vehicle operating characteristic from an on-board unit on the vehicle;

providing a plurality of modular applications that are selectable by the user to create a customized system; and

processing the data corresponding to at least one vehicle operating characteristic obtained via the on-board unit according to at least one function associated with at least one selected modular application.

[c30]   The method of claim 29, further comprising obtaining a set of vehicle parameter values over time.

[c31]   The method of claim 30, wherein the obtaining step includes:
         detecting a triggering event; and
         caching a selected number of parameter readings with respect to a triggering event.

[c32]   The method of claim 31, wherein the caching step includes storing a plurality of parameter readings at selected time intervals.

[c33]   The method of claim 29, further comprising:
         detecting a request for a vehicle controller value;
         outputting a current vehicle controller value if a vehicle controller is available at the time of the request; and
         output a stored vehicle controller value if the vehicle controller is not available at the time of the request.

[c34]   The method of claim 33, further comprising collecting vehicle controller values at a selected time interval and storing a most recent vehicle controller value as the current vehicle controller value.

[c35]   The method of claim 29, further comprising:

detecting at least one of a solicited fault and an un-solicited fault; and firing an alert after the detecting step.

[c36] The method of claim 35, wherein detecting a solicited fault includes filtering faults to output only faults solicited by a user.

[c37] The method of claim 35, further comprising at least one step selected from the group consisting of adding and removing individual faults, canceling the alert service for a given fault after an alert has been fired, firing an alert after a parameter exceeds a selected threshold for a selected time period, and comparing a saved parameter with a current parameter to detect tampering.

[c38] The method of claim 29, further comprising changing at least one vehicle parameter in response to a request.

[c39] The method of claim 29, further comprising translating data between the modular applications and the on-board unit.

[c40] The method of claim 29, wherein the providing step includes providing a remote diagnostics application.

[c41] The method of claim 29, wherein the providing step includes providing a leased vehicle management applica-

tion.

[c42] The method of claim 29, wherein the providing step provides at least one from the group consisting of a remote diagnostics application, a leased vehicle management application, a fuel economy application, a vehicle locating application, a trip reporting application, an engine management application, a maintenance alert application, a vehicle configuration application, and a warranty management application.

[c43] The method of claim 29, further comprising correlating data between at least two vehicle controllers on the same vehicle.

[c44] The method of claim 29, wherein at least one of the plurality of modular applications establishes a setting for a plurality of vehicles with one command sent via the interface.

[c45] A system comprising:

at least one application program operable to originate to and terminate from a target unit electronic messages;

at least one transport module for exchanging with the target unit the electronic messages originated to and terminated from the at least one application pro-

gram, the at least one transport module adapted to provide connectivity to the target unit via at least one of a plurality of networks; and

a communication framework adapted to select one of the at least one transport module based on dynamic-delivery policies, and in turn, to pass between the selected at least one transport modules and the application program the electronic messages originated to and terminated from the target unit .

[c46] The system of claim 45, wherein the at least one application program specifies delivery parameters for carrying out electronic messaging with the target unit.

[c47] The system of claim 45, wherein each of the plurality of networks is of a different communication format type, wherein each of the at least one transport module abstracts parameters indicative of one of the different communication format types to provide connectivity to the target unit via at least one of the plurality of networks, and wherein when the communication framework selects one of the at least one transport module of a given communication format type based on dynamic-delivery policies, it passes between the selected one of the at least one transport module and the application program the electronic messages originated to and terminate from the target unit according to the communica-

tion format corresponding to the given communication format type.

[c48] The system of claim 45, wherein the communication framework includes a multi-part message manager adapted to disassemble messages from the application program and reassemble incoming messages received across one of the plurality of networks from the target unit.

[c49] The system of claim 45, wherein the wireless communication framework is adapted to determine which of the plurality of networks are available to the target, and wherein the wireless communication framework is adapted to select the one or more of the plurality of transport modules that corresponds to the plurality of networks that are available to the target.

[c50] The system of claim 45, wherein the communication framework includes a message storage manager adapted to store the message until the message has been successfully transferred or delivered.

[c51] The system of claim 45, wherein the at least one of the plurality of networks is a wireless network.

[c52] A method for effectuating messaging between a computer and a target unit, the method comprising:

providing a computer including an application program and a communication framework;

dispatching the message from the application program to the communication framework;

processing the message in the communication framework to select at least one of a plurality of transport modules based dynamic-delivery processes, each of the plurality of transport modules being configured to connect to a respective one of a plurality of networks to establish messaging across the respective one of the plurality of networks; and

dispatching the message across a respective one of the networks to the target unit via the selected at least one of the plurality of transport modules.

[c53] The method of claim 52, wherein the step of processing the message in the communication framework includes:

identifying a priority assigned to the message by the application program; and

selecting the transport module based on the priority assigned by the application program.

[c54] The method of claim 53, wherein the step of processing the message further comprises:

selecting at least one transport module corresponding to a reliable network when the priority of the message is high; and

selecting at least one transport module corresponding to a low cost network when the priority of the message is low.

[c55] The method of claim 53, further comprising:
selecting a first of the least one the transport module that corresponds to a low cost network when the priority of the message is mix processing; attempting to dispatch the message through the low cost network over a predetermined time period; selecting a second of the at least one transport module that corresponds to a higher-cost network if the message is unable to be dispatched through the low cost network by a completion of the predetermined time period; and dispatching the message across the higher-cost network.

[c56] The method according to claim 53, further comprising:
batching the message with a plurality of other messages when the priority of the message is batch priority; and dispatching the message in the dispatching step when a predetermined number of the other messages are batched with the message.

[c57] The method of claim 53, wherein the step of processing

the message further comprises:

 determining which of the plurality of networks are available to the target unit; and

 selecting at least one of the plurality of transport modules in the processing the message step that corresponds to one of the available networks.

[c58] The method of claim 53, further comprising the steps of:

 maintaining the message in a storage area hosted by the communication framework when the message is unable to be transmitted to the target unit; and

 transmitting the message to the target unit when the target unit is available for transmission.

[c59] The method of claim 52, further comprising:

 disassembling the message into a plurality of chunks during the step of processing the message; and

 transmitting the plurality of the chunks to the target unit during the step of dispatching.

[c60] The method of claim 59, wherein the step of disassembling comprises:

 disassembling the message into a first predetermined chunk size if an available message size of the network corresponding to the selected transport module is greater than a prescribed size; and

 disassembling the message into a second predeter-

mined chunk size if the available message size of the network corresponding to the selected transport module is less than the prescribed size.

[c61]   The method of claim 59, further comprising maintaining a record of what portion of the plurality of chunks has been sent to the target unit.

[c62]   The method of claim 52, further comprising:

receiving a disassembled message in the communication framework across one of the plurality of networks from the target unit;

reassembling chunks of the disassembled message to form an assembled message; and

transmitting the assembled message to the application program.

[c63]   The method of claim 52, further comprising:

determining if the message is to be sent using reliable delivery in the step of processing the message;

dispatching the message without requiring an acknowledgement when the message is to be sent using non-reliable delivery; and

requiring an acknowledgement from the target unit to verify receipt of the message after the dispatching step when the message is to be sent using reliable delivery.

[c64]   The method of claim 52, further comprising:

assigning an order to the message, by the application program, with respect to at least one other message to form a plurality of prioritized messages in a priority order;

maintaining the message in the communication framework until all of the plurality of prioritized messages are received in the communication framework; and

dispatching each of the prioritized messages according to the priority order.

[c65]   The method of claim 52, wherein the network is a wireless network.

[c66]   The method of claim 52, wherein the network is a satellite network.

[c67]   A method for effectuating messaging between a first unit and a second unit, the method comprising the steps of:

providing the first unit including a first plurality of application programs and a first communication framework, the first communication framework adapted to provide messaging capabilities for each of the first plurality of application programs;

providing the second unit including a second plural-

ity of application programs and a second communication framework, the second communication framework adapted to provide messaging capabilities for each of the second plurality of application programs;

dispatching a message from one of the first application programs to the first communication framework;

processing the message with the first communication framework;

dispatching the message from the first communication framework to the second communication framework via a network;

processing the message with the second communication framework; and

dispatching the message to one of the second application programs.

[c68]   The method of claim 67, wherein the step of processing the message with the first communication framework further comprises selecting at least one of a plurality of transport modules corresponding to the network based on dynamic-delivery policies, each of the plurality of transport modules configured to connect to a respective one of a plurality of networks to establish messaging across the respective one of the plurality of networks.

[c69]   The method of claim 68, wherein the step of processing the message in the first communication framework in-

cludes:

identifying a priority assigned to the message by the application program;

selecting at least one transport module corresponding to a reliable network when the priority of the message is high; and

selecting the transport module corresponding to a low cost network when the priority of the message is low.

[c70] The method of claim 69, further comprising:

selecting a first of the plurality of transport modules that corresponds to a low cost network when the priority of the message is mix processing;

attempting to dispatch the message through the low cost network over a predetermined time period;

selecting a second of the plurality of transport modules that corresponds to a reliable network when the message is unable to be dispatched through the low cost network by a completion of the predetermined time period; and

dispatching the message across the reliable network.

[c71] The method of claim 68, wherein the step of processing the message further comprises:

determining which of the plurality of networks are available to the target unit; and

selecting at least one of the plurality of transport modules in the processing the message with the first communication framework step to correspond to one of the available networks.

[c72] The method of claim 67, further comprising:

maintaining the message in a storage area hosted by the first communication framework when the message is unable to be transmitted to the second unit; and

transmitting the message to the second unit when the second unit is available for transmission.

[c73] The method of claim 67, further comprising:

disassembling the message into a plurality of chunks during the step of processing the message with the first communication framework;

dispatching the disassembled message to the second unit in the dispatching step; and

reassembling the disassembled message in the step of processing the message by the second communication framework.

[c74] The method of claim 73, further comprising:

disassembling the message into a first predetermined chunk size if an available message size of the network corresponding to the selected transport

module is greater than a prescribed size; and disassembling the message into a second predetermined chunk size if the available message size of the network corresponding to the selected transport module is less than the prescribed size.

[c75] The method according to claim 67, further comprising:
determining if the message is to be sent using reliable delivery in the step of processing the message with the first communication framework;
dispatching the message without requiring an acknowledgement when the message is to be sent using non-reliable delivery; and
requiring an acknowledgement from the target unit to verify receipt of the message after the dispatching step when the message is to be sent using reliable delivery.

[c76] The method according to claim 67, further comprising:
assigning an order to the message, by the first application program, with respect to at least one other message to form a plurality of prioritized messages in a priority order;
maintaining the message in the first communication framework until all of the plurality of prioritized messages are received in the first communication framework; and

dispatching each of the prioritized messages accord-
ing to the priority order in the dispatching step.

[c77] The method according to claim 67, wherein the process-
ing in the processing step includes formatting the mes-
sage for the one of the second plurality of application
programs.

[c78] A computer system comprising:

an application program means;

a plurality of transport module means for connecting
to a respective one of a plurality of network means,
the plurality of network means for providing a trans-
port medium for sending and receiving electronic
messaging to a target unit; and

a communication framework means for selecting one
of the transport module means based on dynamic-
delivery policies.

[c79] The computer system of claim 78, wherein the commu-
nication framework means includes a multi-part mes-
sage manager means for disassembling messages from
the application program means and reassembling in-
coming messages received from the target unit.